Claims

1. Method for encoding a sequence of digital data,
   - wherein a portion of the sequence of digital data corresponds to a data block,
   - wherein the data block comprises several data packets,
   - wherein at least two data packets per data block each contain an identifier, with the position of the data packet within the associated data block being determined on the basis of the identifier, and
   - wherein the data is encoded taking said identifier into consideration.

2. Method for decoding a sequence of digital data,
   - wherein a portion of the sequence of digital data corresponds to a data block,
   - wherein the data block comprises several data packets,
   - wherein at least two data packets per data block each contain an identifier, with the position of the data packet within the associated data block being determined on the basis of the identifier, and
   - wherein the data is decoded taking said identifier into consideration.

3. Method according to claim 1 or 2,
wherein the sequence of digital data contains a sequence of progressive data.

4. Method according to one of the preceding claims,
wherein the sequence of digital data contains a sequence of digital image data.

5. Method according to one of the preceding claims,
wherein the data block contains redundancy information.

6. Method according to one of the preceding claims,
wherein a start and an end of the data block are determined by means of the identifier.

7. Method according to one of the preceding claims, wherein the data packets contain information relating to the data block width.

8. Method according to one of the preceding claims, wherein the identifier and the information relating to the data block width are transmitted alternately, in particular according to a predefinable repetition pattern, in a data field.

9. Method according to one of the preceding claims, wherein the number of data packets containing an identifier is predefined in such a way that every n-the data packet receives the identifier.

10. Method according to one of claims 1 to 8, wherein the number of data packets containing an identifier is predefined in such a way that the data field of every n-th data packet contains the identifier and some of the remaining data packets each contain the data block width in their data field.

11. Method according to one of the preceding claims, wherein the at least two data packets containing an identifier are every other data packet.

12. Method according to one of the preceding claims, wherein the data block is an interleaver block.

13. Method according to one of the preceding claims, wherein a sequence of the data blocks is determined.

14. Method according to claim 13, wherein a sequence of the data blocks is determined on the basis of at least one of the following criteria:
- a time stamp,
- a serial number.

15. Method according to one of the preceding claims, wherein a Real-time Transfer Protocol (RTP) is used as the protocol.

16. Method according to one of the preceding claims, wherein the identifier for determining the position of the data packet within the data block is a sequential number.

17. Method according to claim 15, wherein the identifier for determining the position of the data packet within the data block is determined from the sequential number of the RTP.

18. Method according to one of the preceding claims, wherein an unequal error protection method is used.

19. Method according to claim 18, wherein the unequal error protection method used is a UXP method.

20. Arrangement for encoding a sequence of digital data, wherein a processor unit is provided which is embodied in such a way that
- a portion of the sequence of digital data is a data block,
- the data block contains several data packets,
- at least two data packets per data block each contain an identifier based on which the position of the data packet within the associated data block is determined, and
- the data is encodable by these means taking the identifier into consideration.

21. Arrangement for decoding a sequence of digital data, wherein a processor unit is provided which is embodied in such a way that
- a portion of the sequence of digital data is a data block,

- the data block contains several data packets,
- at least two data packets per data block each contain an identifier based on which the position of the data packet within the associated data block is determined, and
- the data is decodable by these means taking the identifier into consideration.

The invention, or any development described in the foregoing, can also be implemented by means of a computer program product having a storage medium on which is stored a computer program that is capable of running on a computer and which carries out the invention or development.

Exemplary embodiments of the invention are shown and explained below with reference to the drawings, in which:

Fig. 1 is a sketch illustrating the principle of an interleaver block,

Fig. 2 is a sketch illustrating a method for encoding digital data,

Fig. 3 is a sketch illustrating a method for decoding digital data,

Fig. 4 shows the structure of a transmission packet,

Fig. 5 shows an instance of determining the position of the data packets within data blocks,

Fig. 6 shows the structure of a transmission system, and

Fig. 7 shows a processor unit.

Fig. 1 is a sketch illustrating the principle of how an interleaver block functions.

A progressive digital data sequence 101 comprising data 1 to 12 has been divided by way of example into three refinement steps, with data 1 to 3 being the most important data, data 4 to 7 being less important, and, finally, data 8 to 12 having in this

redundancy information can be provided as the degree of detail increases. The number of data packets in a data block, what is termed the data block width, can vary per data block.

The length of the identifier should preferably be matched to that of the data field so that the same data field can be used for the identifier for determining the position of the data packet within the data block and for the data block width. If, for example, the data field for the data block width is 8 bits long and the identifier is determined from a 16-bit sequential number in the RTP header, then an 8-bit identifier can be generated from the 16-bit identifier by omitting the higher-value 8 bits.

An arrangement for encoding a sequence of digital data is furthermore disclosed for achieving the object of the invention. Said arrangement provides for a processor unit embodied in such a way that a portion of the sequence of digital data is a data block and contains several data packets. At least two data packets per data block each contain an identifier based on which the position of the data packet within the associated data block can be determined. The data is encodable taking said identifier into consideration.

An arrangement for decoding a sequence of digital data is furthermore disclosed for achieving the object of the invention. Said arrangement provides for a processor unit embodied in such a way that a portion of the sequence of digital data is a data block and includes several data packets. At least two data packets per data block each contain an identifier based on which the position of the data packet within the associated data block can be determined. The data is decodable taking said identifier into consideration.

Said arrangements are suitable in particular for implementing the methods according to the invention or one of their developments elucidated in the foregoing.

tion directly influencing the number of errors that can be corrected.

An additional development of the invention is that a sequence of the data blocks is identifiable, in particular based on a time stamp or on a serial number. The time stamp is a digital identifier indicating, for example, the time at which an item of data, in this case the data block, was sent.

An additional development of the invention is that the identifier for determining the position of the data packet within the data block is a sequential number. Said sequential number is, for example, a serial number of the data packets. For data security reasons a random number or a number "0" or "1" can be selected as the initial value.

In an additional development of the invention a Real-time Transfer Protocol (RTP) is used. RTP makes services available for transmitting real-time data, for example multimedia data. Said services include assigning time stamps and sequential numbers to data packets.

The sequential number of the RTP is used within the scope of said development to define the identifier for determining the position of the data packet within the data block.

An additional development of the invention is that a method for unequal error protection, for example UXP, is used. Progressive data within a data block is hereby in each case provided with a different amount of redundancy information in order in particular to take into consideration the fact that said progressive data of a unit, for example an image, requiring to be represented, builds one set upon another, which is to say the different stages in the progression are to be taken into account in distributing the redundancy information. It is of practical advantage to provide a large amount of redundancy information at the beginning of the progressive data, while increasingly less

In an additional development of the invention the data packets each contain information relating to the width of the data block.

In another development of the invention the identifier and the information relating to the data block width are transmitted alternately, in particular according to a predefinable repetition pattern, in a data field. This is advantageous as only a single data field is required for transmitting the identifier and the information relating to the data block width and the volume of data to be transmitted does not increase despite the additional functionality.

An additional development of the invention is that the number of data packets containing an identifier is predefined in such a way that every n-the data packet receives the identifier.

Another development of the invention is that the number of data packets containing an identifier is predefined in such a way that the data field of every n-th data packet contains the identifier and some of the remaining data packets each contain the data block width in their data field.

In another development of the invention the predefinable number of data packets containing an identifier is every other data packet.

In an additional development of the invention the data block is an interleaver block. In the encoding device the data is hereby read, for example, row by row into the interleaver block and, for example, column by column from the interleaver block and then transmitted. If a data packet, which is to say a column of the interleaver block, is lost during data transmission, this data loss will be distributed over the rows of the interleaver block. If the data rows contain redundancy information, these errors can be corrected up to a certain number by means of an error correction method, with the amount of redundancy informa-

data packets. At least two data packets per data block each contain an identifier based on which the position of the data packet within the associated data block is determined. The data is decoded taking said identifier into consideration.

An advantage of the invention is that by means of the identifier the positions of the received data packets within the associated data block can be immediately determined at the beginning of data transmission and/or when data packets are lost. The effort and expense required for data buffering being substantially reduced, it is consequently also possible to run a real-time application, for example video telephony or any other multimedia application. The buffer for the data can thus also be significantly reduced in size in the decoding device or even totally dispensed with.

A development of the invention is that the sequence of digital data comprises a sequence of progressively encoded data (= progressive data), for example progressively encoded images or image data streams, with its also being possible for the progressive data to be image data. Progressive data is temporally staggered in terms of its degree of detail, meaning that the image, for instance, is initially transmitted with a coarse resolution so that, although said image can indeed be represented, its details are largely unrecognizable. Image refinements are thereafter transmitted step by step so that the image's resolution constantly improves as transmission progresses further.

In an additional development of the invention the data block includes redundancy information. This enables an error correction method to correct data errors occurring during transmission and to reconstitute the data.

Another development of the invention is that a beginning and an end of the data block are determined on the basis of the identifier of the data packets.

redundancy information. Known error correction methods are employed for this (see [4]).

A method for the unequal error protection (UXP) of data whereby error protection is varied within a data block by assigning the data different amounts of redundancy information is described in [5]. According to [5], a number of the data packets in a data block is variable and is indicated in a separate data field in the UXP header assigned to each data packet.

Some data packets are lost when data is transmitted on faulty channels. This is especially disadvantageous when also involving the loss of data packets which each include a marker bit indicating the limit of the data block. In this case, before being decoded the data packets will have to remain buffered until their positions within the individual data blocks or, as the case may be, the limits of the various data blocks can be reconstituted.

The **object** of the invention is therefore to make it easier to reconstitute the limits of the data blocks.

Said object is achieved according to the features of the independent claims. Developments of the invention will emerge from the dependent claims.

A method is disclosed for encoding a sequence of digital data for achieving said object. A portion of said sequence of digital data corresponds to a data block and comprises several data packets. At least two data packets per data block each contain an identifier based on which the position of the data packet within the associated data block is determined. The data is encoded taking said identifier into consideration.

Said object is furthermore achieved by means of a method for decoding a sequence of digital data. A portion of said sequence of digital data corresponds to a data block and comprises several